PROJECT #1

ADJUSTABLE SCISSOR-LIFT LAMP

DESIGN. BUILD. ITERATE.

> “A simple everyday ‘bug’ became an opportunity to explore mechanical design, optics, and user-centered engineering in a product I could use every day.”

ABOUT THIS PROJECT

Living in a shared dorm room meant I often needed to work late at night without disturbing my roommate. Traditional desk lamps either spilled too much light or lacked the flexibility needed for different tasks.

The goal of this project was to design and build a fully adjustable desk lamp featuring a custom scissor-lift mechanism, swiveling head, and adjustable optical system capable of changing the light beam from a narrow spotlight to a wide floodlight to create a compact, versatile lighting solution that provided effective task lighting while minimizing disturbance to others.

KEY SPECS

HEIGHT
Adjustable from
25 - 80 cm

WIDTH
20 cm

SWIVELLING HEAD
360 degrees

BEAM
Adjustable from
spotlight to floodlight

WEIGHT
~1 kg

COST
~ US 25

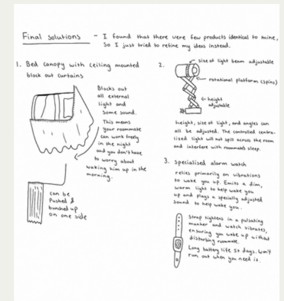
MATERIALS

- Wood (Laser-cut)
- Plastic (3D-Printed)
- Fasteners
- Radial Ball Bearing
- Adjustable flashlight
- Electrical tape

TOOLS

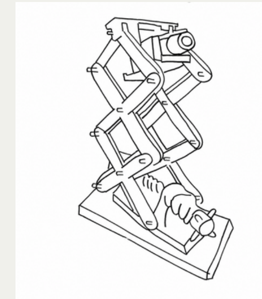
- Bandsaw
- Handheld Jigsaw
- Hacksaw
- Drill & Drill Press
- Mallet
- Screwdrivers
- Files & Sandpaper
- Belt- & Disc Sander
- Measuring Tools
- Laser Cutter
- Bambu Lab 3D Printer

DESIGN & BUILD PROCESS



01
IDEATE

Identified options for highly directional task lighting that could adapt to different work positions, tasks, and daytime/nighttime illumination needs



02
DESIGN

Developed scissor-lift geometry, adjustable head mechanism, and structural components. Refined proportions for stability, usability and appearance

03
PROTOTYPE & BUILD

Created foamboard/straw prototypes and fabricated mechanical components, assembled the structure, installed electrical components, and integrated the optical system

04
TEST & ITERATE

Tested height adjustment, stability, head articulation, and beam control. Refined friction, movement, and overall ergonomics through multiple design iterations

KEY CHALLENGES

ADJUSTABILITY
Difficult to identify the most stable yet adjustable system. Tested various options before settling on a scissor lift mechanism that offered maximum stability even at the highest height setting

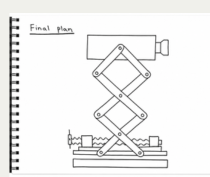
LIGHT CONTROL
Challenging to design the easiest system to transition the light source from a focused spotlight to a wider floodlight

FLEXIBILITY
Modified the design several times to ensure maximum adjustability in terms of lamp height, stability, illumination range, and light focus

ADJUSTABLE LIGHT BEAM

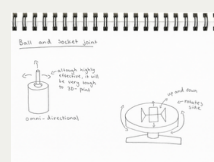
Dial in the perfect beam size for any task or environment.

BUILD DETAILS



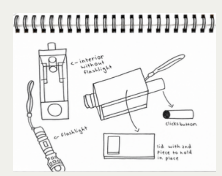
SCISSOR MECHANISM

Custom designed linkage system providing smooth vertical adjustment



SWIVEL BASE

Multi-axis articulation allowing flexible lamp positiioning



OPTICAL SYSTEM

Variable-focus lens producing a narrow spotlight and wide floodlight modes

MECHANICAL ASSEMBLY

Integrated structural, electrical and optical components into a single functional product

LINK: PRODUCT INTRODUCTION VIDEO
https://www.youtube.com/watch?v=a9AKOKBAav8

OUTCOME & WHAT I LEARNED

This project demonstrated how thoughtful engineering can improve everyday experiences. By designing around a real user need rather than simply adding features, I learned the importance of balancing functionality, usability, aesthetics, and manufacturability.

Beyond improving my mechanical design and fabrication skills, the project taught me how iterative prototyping leads to better engineering solutions.

MECHANICAL DESIGN | FABRICATION | PROTOTYPING | PROBLEM SOLVING | SYSTEMS THINKING

PROJECT #2

DIY ROWING MACHINE

DESIGN. BUILD. ITERATE.

> "Commercial rowing machines are expensive. I wanted to see if I could design and build one using simple tools and readily available materials, that can be easily replicated and built by other students."

ABOUT THIS PROJECT

During the pandemic, when schools, gyms and sports clubs were shut down, I wanted a way to stay in shape at home.

Commercial rowing machines were out of budget for students like me, so I challenged myself to design and build a functional rowing machine using mostly off-the-shelf parts and basic tools.

The goal was to create a low-cost machine that replicates the motion and resistance of a rowing ergometer, which can be easily built by other kids using readily available and recycled materials.

KEY SPECS

LENGTH
250 cm

WIDTH
45 cm

HEIGHT
70 cm

WEIGHT
~20 kg

COST
~Euro 150

MATERIALS

- Solid Wood Beams and Planks
- Bicycle Wheel & Chain
- Steel Rod (Axle)
- Steel Cable
- Bungee Cord
- High-Density Foam (Seat)
- Velcro Straps (Footpad)
- Bicycle Handles
- Heavy-Duty Carabiners
- Pulley
- Miniature wheels

TOOLS

- Handheld Saw
- Jigsaw
- Handheld Drill
- Hammer and Mallet
- Wood Clamp
- Nails and Wood Glue
- Screwdrivers & Wrenches
- Screws, Nuts, and Bolts
- Files, Sander & Sandpaper
- Measuring Tools

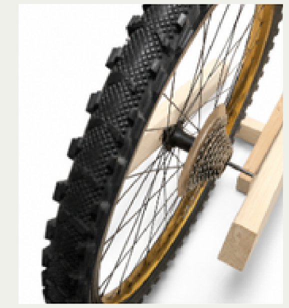
DESIGN & BUILD PROCESS

01
IDEATE

Identified users' needs. Sketched multiple concepts and researched different mechanisms.

02
BUILD

Built the frame and rail system out of solid wood beams. Designed ergonomic wooden handles, seats, and footplates



03
INTEGRATE

Integrated the drive-train system (handle, chain, and bungee cords) that transfers the force of the user's pull, to the resistance mechanism (wheel and axle)

04
TEST & ITERATE

Tested, identified issues, and iterated on key components for performance, durability, and safety.

KEY CHALLENGES

CREATING REALISTIC RESISTANCE

Tested different resistance mechanisms, including air, water systems (e.g., wheel, propeller, pulley, water paddle before settling on a bicycle-wheel-based system tethered to a chain and bungee cord, which was easy to source and build, and allowed for a smooth and effective motion. Tested different cord widths and lengths to increase resistance.

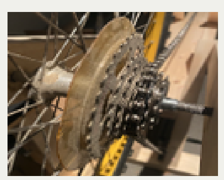
MAINTAINING SMOOTH MOTION

Iterated on seat alignment, guardrail heights, and wheel placement to minimize friction and eliminate wobble. Tested varying lengths of chain-cord-chain combinations to allow for full extension and sufficient resistance

STRUCTURAL STABILITY

Iterated solutions to secure the flywheel to the axle without impacting its rotation after early testing showed the wheel shifting and rattling during heavy use.

BUILD DETAILS



FLYWHEEL

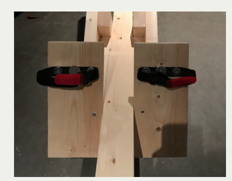
The flywheel, steel axle, and chain form the heart of the resistance system.

CABLE / CORDS

Handle, chain, cable (tether), and elastic cord (return spring) form the drive-train system.

ROLLSEAT

The seat glides smoothly on integrated wheels, while integrated wooden guardrails keep it securely aligned, improving stability and user safety.



FOOTPAD

Adjustable velcro straps accomodate different size feet. Wooden plates angled appropriately for comfort.

OUTCOME & WHAT I LEARNED

The result is a fully functional rowing machine that is inexpensive and easy to build. I shared the blueprint and instructions with my schoolmates during the pandemic. This project taught me how to take an idea from concept to finished product through iteration, problem-solving, and attention to detail.

MECHANICAL DESIGN | FABRICATION | PROTOTYPING | PROBLEM SOLVING | SYSTEMS THINKING